NOTES ON DISTRIBUTION AND A PECULIAR BEHAVIOR PATTERN IN *NEBRIA PURPURATA* LECONTE (COLEOPTERA: CARABIDAE).[1]

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ABSTRACT

In a population of *Nebria purpurata* LeC. in the Sangre de Cristo Range, New Mexico, we observed differences in nocturnal behavior between copulating pairs and uncoupled individual adults. Copulating pairs were found on emergent rocks in a stream and were seen entering the water and swimming on the surface. Uncoupled individuals were observed only on the stream bank.

Nebria purpurata LeConte is a carabid beetle known from several ranges in the Rocky Mountain system in Colorado (Erwin and Ball, in press) where it is virtually restricted to Alpine and Subalpine (Marr, 1967) life zones. Hatch (1939, 1953) and Lindroth (1961) listed records for *N. purpurata* from Idaho and Montana (state records only); but these records are instead based on large specimens of *N. gebleri* Dejean.

While collecting in the Sangre de Cristo Range of northeastern New Mexico on June 11, 1971, we observed an interesting and unexpected type of behavior in adult *N. purpurata*. The locality data is as follows: New Mexico, Taos County, Sangre de Cristo Range, 2.2 miles west of Red River P. O., June Bug Campground, Red River, elevation: 8550 feet, 11-VI-71. This constitutes the first record in New Mexico as well as the first verified record for the species outside of Colorado. This locality is in the Upper Montane zone (Marr, 1967), where the dominant tree species are *Picea engelmannii*, *Pseudotsuga menziesii*, and *Pinus ponderosa*. Streamside dominants include species of *Salix*, *Alnus*, and *Populus*. We failed to find additional specimens upstream in Alpine and Subalpine zones. This suggests that ecological differences may exist between this population and those in Colorado. The taxonomic significance of this situation will be evaluated in conjunction with a major revision of the genus *Nebria* now in progress (D. H. K.).

First collections in the area were made in daylight at about 7:30 p.m. Specimens of *N. purpurata* were found under small rocks along the rocky banks of the river on wet sand. The river was approximately 20 feet wide at this point and up to 3 feet deep. Water temperature 12 inches from shore and at a depth of 6 inches was 11°C; air temperature at waist height was 16°C.

To obtain a larger series of these nocturnal beetles, we returned to the locality and collected on an adjacent section of river bank between 11:30 p.m. and 1:00 a.m. using flashlights. Water and air temperatures (at

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same positions as above) were, respectively, 5°C and 8°C. Immediately upon reaching the collecting site, we observed a pair of *N. purpurata* adults *in copulo*, sitting on a small, emergent rock about 4 feet from shore. The beetles were disturbed by the flashlight and immediately raced into the water, still in tandem. Several additional copulating pairs were observed within the next few minutes, each sitting motionlessly on emergent rocks well into the stream. Two more copulating pairs were seen on the bank itself. One pair was moving along the bank parallel to the stream, about 3 inches back from the water. The second pair was discovered just as it entered the water, while maintaining the copulating position. We dimmed the flashlights in an attempt to reduce their disturbing effect and were able to follow the progress of these beetles on the surface of the stream for some distance before we lost sight of them in the ripples. This pair was able to navigate in the swift current, move across the current, and even remain in the same spot (in line with a fixed point on shore) on the surface without being displaced downstream. We observed surprisingly few swimming movements during execution of these maneuvers.

We found several uncoupled individuals moving on the bank, generally parallel to the stream margin; but none were seen entering the water, on the water surface, or on emergent rocks in the stream.

Individuals of *N. purpurata* have markedly reduced wing apices and are, therefore, incapable of flight. The copulating pairs described above could have reached the small rock "islands" only on or in the water. While no pair was actually seen reaching and boarding a rock in the stream, observations of the pair seen entering the stream and navigating on its surface suggest: 1) that other pairs reached the rocks via the water surface, and 2) that these pairs made their crossings in tandem rather than as individuals.

In the copulating position, the female is below and the male above, with all legs of the male totally free of the substrate. He clutches the female with the anterior 2 pairs of legs, with the posterior pair either extended freely or also clutching the female. On firm substrates, all locomotory movements are made by the female while the male gets a "free ride". Swimming movements on the water surface are probably also made only by the female.

While we had observed individuals of numerous species of *Nebria* displaying navigatory skills on the surface of streams, it was surprising to see a copulating pair demonstrate these same abilities. The full significance of this behavior pattern in the copulating pair will become evident only after much more study. We are confident that our observations are not of artifacts of our activity in the area. The facts that no uncoupled individuals were seen on the emergent rocks, that few copulating pairs were seen on the bank, and that the pairs in the stream had already reached and settled on the rocks before our arrival, all indicate that the observed behavior is natural.

The ability of individuals of many species of *Nebria*, as well as those of many other carabid species, to navigate on the surface of flowing water is easily observed. For organisms which occupy a riparian habitat, the capacity to return to the bank after a "voyage" (whether intended or acci-

dental) is a valuable if not necessary one. The ability to remain on the water surface is probably essential; but to be able also to navigate on the surface, against or across the current, may prevent an individual from being swept downstream and effectively removed from its population. This is most important for those organisms which live in restricted altitudinal zones along mountain streams. In such instances, to be swept downstream is to be displaced from a habitat suitable for both reproduction and survival. This displacement may be irreversible for wingless forms.

It may be simplest to view the navigatory capacity of these beetles strictly as adaptation to the hazards of the riparian habitat. However, observations of behavior such as that outlined above suggest that much more may be involved. Indeed, the extent to which organisms in this habitat use the adjacent waterway for "intentional" (such as simple locomotion, dispersal, etc.) rather than accidental movements has been virtually unexplored. Perhaps the distinction between the terms "terrestrial" and "aquatic" is far more arbitrary than we now realize.

References

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Book Review

Classification and biology by R. A. Crowson. 1970. Atherton Press Inc., 70 Fifth Ave., N.Y., N.Y. 10011. 350p.; $8.95, cloth.

Most of our readers are familiar with the author's major work on beetles, "The natural classification of the families of Coleoptera" first published in 1955 and reprinted in 1968. This new book on classification was 10 years in preparation and has numerous innovative approaches to the subject. Crowson readily admits that (like Hennig, but independent of his ideas) his is a " . . . strictly phylogenetic approach to the subject." The book contains 22 chapters, a bibliography of 217 titles, and a thorough index of 30 pages. As would be expected, beetles are often used as examples to clarify general points.

The book contains a great amount of personal opinion and general philosophy—but an honest appraisal of current problems. His chapter on the "working taxonomist" contains so many truths that it emphasises the discouraging aspects of his chapter on "the future of systematics." Very few sciences are burdened with the volume of literature and the inherent difficulties of our nomenclatural system. Crowson states it thusly, "In order to be in a position to make permanently valuable additions to botany and zoology, each generation has need first to assimilate and evaluate all that its predecessors have achieved. Real scientific progress has meant that this task has become more and more onerous for each succeeding generation." How true it is.—R. E. Woodruff.